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by

Margherita Russo
Department of Economics Marco Biagi,
University of Modena and Reggio Emilia, Italy, margherita.russo@unimore.it

Annalisa Caloffi
Department of Economics and Management,
University of Padua, Italy, annalisa.caloffi@unipd.it

Federica Rossi
Department of Management, Birkbeck College,
University of London, United Kingdom, f.rossi@bbk.ac.uk

Riccardo Righi
Department of Economics Marco Biagi,
University of Modena and Reggio Emilia, Italy, riccardo.righi@unimore.it

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Margherita Russo[1], Annalisa Caloffi[2], Federica Rossi[3], Riccardo Righi[1]

[1] Department of Economics Marco Biagi, University of Modena and Reggio Emilia, Italy
margherita.russo@unimore.it
[2] Department of Economics and Management, University of Padua, Italy,
annalisa.caloffi@unipd.it
[3] Department of Management, Birkbeck College, University of London, United Kingdom,
f.rossi@bbk.ac.uk

Abstract

A growing number of innovation policies provide funding for innovation intermediaries, with the aim to remedy some of the system failures that occur within local, regional and national innovation systems. In order to induce innovation intermediaries to behave in accordance with the policies' objectives, public funding is often conditioned on their attainment of minimum performance targets measured through indicators, whose design is therefore crucial for the policies' success. Focusing on the case of a regional policy programme in Italy, the paper shows that policymakers' choice of performance indicators that were only loosely tied to the policy's objectives, prompted intermediaries to adopt behaviours that were misaligned with those objectives. The paper then presents a reflection on how to design performance indicators that encourage intermediaries to most appropriately address relevant failures in their innovation systems.

Keywords: performance-based funding; innovation policy; innovation intermediaries; innovation poles; evaluation; technology transfer

1. Introduction

Intermediary organisations that support firm-level and collaborative innovation, often called 'innovation intermediaries', have gained increasing prominence in knowledge-intensive economies (Howells, 2006; Lazaric *et al*., 2008). Innovation intermediaries (henceforth: intermediaries) are a varied set of organisations that, while differing in nature and status (public, private, or mixed), provide 'linking' or 'networking' services that include, among others, support to research and development (R&D) partnership formation and to university-industry collaborations. They may also provide other knowledge-intensive services, such as knowledge and technology mapping, technical assistance in R&D projects, dissemination and commercialisation of results (Bessant and Rush, 1995; Lynn *et al*., 1996; Hargadon and Sutton, 1997; Den Hertog, 2000; Howells, 2006; Lee *et al*., 2010; Wagner *et al*., 2014). While typical intermediaries include knowledge-intensive business services providers, technopoles, technology transfer agencies, science parks and incubators, a wide range of organizations can provide at least some intermediary functions (Howells, 2006).

Since intermediaries can facilitate knowledge exchange among organisations with different languages, cultures, decision-making horizons, systems of incentives and objectives (Howells, 2006; Russo and Rossi, 2009; Caloffi *et al.*, 2015), they can play an important role in promoting innovation within local, regional and national innovation systems (Kauffeld-Monz and Fritsch, 2013). In fact, policies worldwide have relied on intermediaries in order to support R&D, innovation, and technology transfer (Martin *et al*., 2011; Uotila *et al*., 2012; Knockaert *et al.*, 2014; Fiordelmondo *et al.*, 2014).

In order to induce innovation intermediaries to act in accordance with the policies' objectives, public funding is often conditioned on their achievement of certain performance targets. However, this is likely to occur only if there is close alignment between the indicators used to measure the targets' achievement and the policies' intended objectives: hence, the identification of appropriate indicators is a complex operation that is crucial for the policy's success.

Although a debate is emerging on how to evaluate intermediaries' performance (Nishimura and Okamuro, 2011; Knockaert *et al.*, 2014), little research exists on how the use of performance indicators affects the intermediaries' behaviour. Studies of policy implementation have shown that,

despite their importance, performance indicators are usually designed heuristically, often based on past experience, rather than grounded theoretically (Sizer, 1979; Jesson and Mayston, 1990; Curristine, 2005; Molas-Galart and Davies, 2006). Heuristic approaches can result in indicators that focus only on a few activities, or on relatively unimportant ones, just because they are easier to measure (Robichau and Lynn, 2009; Rossi and Rosli, 2015). Such indicators are ineffective, not only because they provide a biased evaluation of performance, but also because they create an implicit incentive system that alters the behaviour of the assessed units (Langford *et al.*, 2006; Compagni and Tediosi, 2012; Rafols *et al*., 2012; Texteira and Koryakina, 2013; Rabovsky, 2014). This incentive system can produce undesirable effects if it is not fully aligned with the policy objectives (European Commission, 2013; Li, 2015).

Our study aims to provide a theoretical framework to address the mismatch between the policies' objectives, on the one hand, and the indicators used to evaluate the intermediaries' performance, on the other. It does so by conceptualising the variety of activities carried out by intermediaries, and the ultimate objectives that they should achieve, in terms of system failures (Klein Woolthuis *et al*., 2005), and by linking the intermediaries' performance to their success in remedying such failures. Indeed, literature has shown that a middle-range implementation theory is needed, which links inputs to desired community outcomes through the actions of an intermediary (Shea, 2011). The system failures approach can then provide a guide to the design of appropriate indicators. These issues are illustrated through a case study of publicly-funded innovation intermediaries in the Italian region of Tuscany in 2011-2014. We show that the indicators used to allocate public funding, being only loosely tied to the policy's objectives, induced the intermediaries to pursue behaviours that allowed them to reach their performance targets rapidly, but that were misaligned with the policy's ultimate goals. We also show that conceptualising the intermediaries' objectives in terms of addressing system failures could have helped to design more appropriate performance indicators. It is worth noting that the case of Tuscany is not unique: other Italian regions adopting similar innovation policies used similar sets of indicators to evaluate the performance of innovation intermediaries. In addition, some of these indicators are among the most commonly used by policymakers around the globe (Comacchio and Bonesso, 2012).

The paper is structured as follows. In section 2 we review the literature on system failures in relation to publicly-funded innovation intermediaries, and we propose a framework to conceptualise the intermediaries' objectives in terms of remedying system failures. Section 3 presents the data and sections 4 and 5 discuss limitations and effects of the indicators used by the regional government. Section 6 proposes the use of a systems failure framework to improve the evaluation of innovation intermediaries by aligning indicators with the policy objectives. Section 7 concludes.

2. A systems failure view of publicly-funded innovation intermediaries

In recent years, innovation intermediaries have been targeted by policies supporting innovation and technology transfer, whose aim is to strengthen the performance of an innovation system by addressing failures therein (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Edquist and Johnson, 1997). Intermediaries may address all main types of system failures, as identified by Klein Woolthuis *et al*. (2005): infrastructural, capabilities, interaction and institutional failures.

First, intermediaries can remedy a failure in the information infrastructure of the innovation system (Malerba, 2009), by diffusing information about opportunities for collaborations with other actors (Bougrain and Haudeville, 2002), as well as about useful and applicable techniques or technologies for product and service development (Howard Partners, 2007; Rosenkopf and Nerkar, 2001).

Second, intermediaries can help firms, particularly small and medium-sized enterprises (SMEs), to boost their innovation capabilities by directly providing training or support services, or by intermediating the provision of services that are able to solve the actors' managerial failures, which are a form of capabilities failures (Bessant and Rush, 2005). These failures occur when firms do not know how to acquire useful knowledge or technologies, or how to usefully implement them into product and services. Moreover, actors may not just lack certain knowledge or technologies but they may be unaware of what they are lacking (Brusco, 1992; Kaufmann and Tödtling, 2002), which is a form of 'awareness failure'. Through activities such as knowledge and technology mapping, innovation intermediaries can help actors gain awareness of what they need, in order to find the most appropriate way to obtain it.

Third, intermediaries can address interaction failures by creating connections between people in different organisations; they can do so through networking activities such as targeted introductions and meetings, general networking, and provision of appropriate interaction spaces where actors can meet freely (Etzkowitz and Leydesdorff, 1998; Acworth, 2008; Kodama, 2008; Rossi *et al.* 2010). This can be particularly helpful to newly created firms and SMEs, which are usually less open than other organisations to external collaborations (Rothwell and Dogdson, 1991). Intermediaries can support interactions also because they are (supposed to be) able to bridge different knowledge and competencies. One of their main capabilities is precisely that to solve cognitive failures, which occur when actors from different institutional backgrounds are too cognitively distant to adequately learn together (Nooteboom, 2000), or have different norms, values and incentive systems that hinder effective communication (Klerkx and Leuuwis, 2009).

Finally, intermediaries can address the lack of formal or informal institutions supporting innovation. They can provide firms with information, advice or other services related to formal institutions (for example, support with patent search and patent licensing). Furthermore, they can facilitate the emergence of social norms that underpin good innovative performance, as when their support for collaborations promotes mutual trust.

Table 1 summarizes the key system failures that innovation intermediaries can address, and the activities through which they may do so, with the ultimate objective to strengthen their innovation system. It can be argued that intermediaries' activities aim to improve the resources (information, networks) and capabilities (competences, skills) of the economic actors in the system, thus leading them to change their innovative behaviours and achieving better innovation performance.

Table 1. A system failures framework to conceptualise the key functions and related activities of publicly-funded innovation intermediaries

General system failures categories	Specific system failures that can be addressed by intermediaries	Sources of system failure	Examples of innovation intermediaries' activities that can help solve system failures
Infrastructure failures	Information failures	Economic actors lack information about sources of external knowledge and opportunities	Diffusion of information about existing opportunities
Capabilities failures	Managerial failures	Economic actors are unable to exploit knowledge and opportunities due to lack of adequate competences and skills	Direct provision of knowledge-intensive services Intermediation in the provision of knowledge-intensive services Training and education activities
	Awareness failures	Economic actors lack awareness of their own needs for information, knowledge, competences	Knowledge and technology mapping
Interaction failures	Networking failures	Economic actors lack connections between them, due to weak or strong network failure	Targeted introductions and meetings General networking Provision of interaction spaces
	Cognitive failures	Economic actors are unable to interact due to cognitive distance	Leading collaborative innovation projects Leading communication within interaction spaces Mobilizing resources for collective initiatives
Institutional failures	Formal or informal institutional failures	Economic actors are unwilling to innovate due to the lack of formal of informal institutions	Diffusion of information that can help the diffusion of formal institutions (e.g. on standards or IPRs) Direct provision of services related to formal institutions (e.g., support for applying for a license or a certification) Lobbying activity towards policymakers to stimulate the creation of formal institutions Facilitating the emergence of social norms that promote collaboration

While the system failure framework provides an implicit or explicit rationale for the public funding of innovation intermediaries, policymakers rarely allocate such public funding based on the intermediaries' ability to deal with system failures. When funding is conditioned to the achievement of minimum targets in certain performance indicators, the latter are usually defined in terms of the intermediaries' production of specific outputs that are considered desirable in

themselves, without a clear link to how achieving such targets would serve the policy objective to address certain system failures. Moreover, little attention is paid to the behavioural incentives that performance indicators create, in order to ensure that they are aligned with the policy objectives (Comacchio and Bonesso, 2012; European Commission, 2013).

It is well known that policymakers' choice of performance indicators can influence the behaviour of the funding recipients. As aptly pointed out by Fitz-Gibbon (1990, p. 2) "for every performance indicator questions must be asked about the implicit messages, and the behavioural implications. In other words, knowing that certain indicators are being collected and monitored, what implications do people draw? How will they respond to the situation?". Intermediaries may aim for good performance scores in the indicators, disregarding other potentially important objectives, the attainment of some of which may not be easily measurable. Intermediaries may also be tempted to engage in activities that produce immediate outputs, and neglect activities that would yield results only over a longer time horizon than that considered by evaluators. For example, Gulbrandsen and Rasmussen (2012) showed how, in the case of the Forny technology transfer programme in Norway, the indicators used to determine the annual bonus payments for technology transfer offices had to be changed several times, since the latter would alter their strategies in line with the incentives created by the indicators, sometimes with adverse consequences. In particular, using the number of spinoff companies as an indicator of performance led them to launch too many firms too early.

Efforts should be made to identify performance indicators that encourage intermediaries to most appropriately address relevant system failures. To do so, first, policymakers should identify the full range of intermediaries' activities and pay particular attention to those that are instrumental in addressing the key failures, this way avoiding the risk of omitting important activities from the evaluation just because they are less visible or less easy to measure. Second, policymakers should devise performance indicators that encourage intermediaries to remedy the sources of system failures. Most of the indicators that are used in practice refer to the *outputs* that intermediaries produce (Comacchio and Bonesso, 2012) (for example: how many patents have they applied for, or have they facilitated? How many collaboration agreements have they signed? How many

services have they provided?). Instead, indicators should be closely linked to the *outcomes* that the economic actors in the system achieve thanks to the activity of the intermediaries. It must be noted that, recently, numerous criticisms of output indicators have led to greater emphasis on the use of outcome indicators (or results indicators), also in the evaluation of regional policy (European Commission, 2014). However, the use of outcome indicators in itself does not necessarily address the mismatch between the policy objectives and the indicators defined by policymakers. Building on the system failures framework outlined in Table 1, we argue that performance indicators should measure whether the economic actors have acquired resources (information, services, contacts) and have engaged in learning processes that have allowed them to improve their capabilities to engage in innovation (for example, through better communication and negotiation skills, greater awareness of their own abilities and of their limitations, greater understanding of the process of collaboration, greater trust and openness toward external collaborations) which in turn have led to changes in their behaviours (for example, greater networking activity, changes in the types of partners they interact with, changes in the type of innovation processes they perform) and possibly in performance (more innovation, greater profitability and so on).

3. The regional innovation poles

We rely on a case study to illustrate the implications of the mismatch between performance indicators and the policy's ultimate objectives, and to showcase an improved approach to performance evaluation. The case study concerns a policy intervention implemented by the Italian region of Tuscany in 2011-2014, through which the regional government funded twelve innovation poles, a particular type of innovation intermediary. Poles were consortia between universities and research centres, knowledge-intensive service providers and firms. Each consortium was led by a managing organisation that decided what services to provide and how to organize the poles' many activities. Firms that intended to use an innovation pole's services would have to gain membership of that pole.

The policy intervention relied on two complementary instruments: the creation of the poles and the provision of grants to buy knowledge-intensive services.

With the first instrument, Tuscany's regional government identified a set of key technologies/applications, and launched a call for tender (in 2010) inviting organisations to submit proposals for the creation of poles for a three-year period (2011-2014). The aim was to strengthen the regional infrastructure supporting innovation, by stimulating collaborations between existing organisations that performed innovation intermediary functions. Before this policy, the region hosted a relatively large set of small-scale intermediaries, which often did not reach the minimum size needed to efficiently provide enterprises with high quality services (IRIS Toscana, 2008). The new, larger intermediaries were expected to act more vigorously to support innovation in local firms. For the first three years, the poles were experimental in character. Afterwards, having evaluated their accomplishments, the policymaker would then decide how to structure subsequent interventions. Table 2 lists, for each innovation pole that had been selected for funding, its key technology/application, the number of organisations in the consortium and the number of members at the start (30.6.2011) and end (30.6.2014) of the three-year period.

Table 2.Key technologies/applications, consortium participants, pole members

Innovation pole (acronym)	Key technologies/applications	N. of organisations in the consortium	N. of pole members as of 30.06.2011	N. of pole members as of 30.06.2014
OPTOSCANA	Optoelectronics for manufacturing and aerospace	2	67	92
INNOPAPER	Paper	1	89	139
OTIR 2020	Fashion (textiles, apparel, leather, shoes, jewellery)	7	223	501
VITA	Life science	8	41	158
PIETRE	Marble	4	52	122
PENTA	Shipbuilding and maritime technology	5	225	352
POLIS	Technologies for sustainable cities	8	228	643
NANOXM	Nanotechnologies	6	70	128
CENTO	Furniture and interior design	6	177	322
PIERRE	Renewable energies and energy saving technology	13	120	368
POLO12	Mechanics, particularly for automotive and transport	6	198	390
POLITER	ICT and robotics	13	195	697

Source: our elaborations using data provided by Tuscany's Regional government

The poles received regional funds to carry out the following activities:

1. marketing to recruit new members, including technology mapping activities to encourage firms to demand knowledge-intensive services and to invest in innovation;

2. direct provision of knowledge-intensive services;
3. participation in regional, national and European R&D projects; organisation of knowledge transfer programmes, workshops and seminars to facilitate knowledge sharing and networking among members;
4. management of open access infrastructures such as research laboratories.

The second instrument aimed to encourage local firms to join the poles and participate in their activities: firms that bought knowledge-intensive services that were either directly provided or intermediated by the poles, would be given a subsidy equal to 80% on the service price.[1]

The policymaker expected the poles to expand the pool of users of innovation services, particularly involving those SMEs that had little understanding of their needs and were unable to express a 'demand for innovation'. By recruiting new member firms and mapping their needs, the poles would help firms to find the most appropriate knowledge-intensive services. In turn, by gaining access to knowledge-intensive services, SMEs would improve their innovation capabilities, which would generate positive spillovers in the regional innovation system.

Public funding was allocated to innovation poles in two instalments: up to 70% over the course of the three years, and the rest at the end. The funding was conditional upon the achievement of a set of minimum performance targets, which had to be reached by the end of the three-year period. The tender stated that innovation poles would be assigned to one of three possible 'bands' depending on how many members they had at the time of their launch. Different performance targets were set for the different bands. Targets were defined as minimum thresholds with respect to several indicators:

i) percentage increase in the number of member firms;
ii) number of member firms that were offered knowledge and technology mapping services;
iii) number of services provided to firms, and revenue from the sale of

[1] This incentive existed before the creation of the poles: since 2008, SMEs could apply for public subsidies for the purchase of various types of knowledge-intensive services. The admission to the incentive was semi-automatic (it was based on compliance with a set of formal criteria, including company size) and granted a reduction in the range of 20-60% on the cost of the service.

services.

Table 3 shows, for each band, the minimum number of members required at the start of the period, the performance targets to be achieved over the three years, and the maximum funding that poles could claim from the regional government had they reached these targets. The performance target had been set at the start of the policy programme and poles were aware of these targets from the start.

Table 3. Performance targets and maximum funding that could be claimed by innovation poles in each of the three bands

	Criterion for allocation into bands: N. member firms(at launch)	**Performance targets to be achieved within three years (minimum thresholds)**				**Maximum funding that could be claimed from the Regional government**
		% increase in the number of member firms	**N. firms to be offered knowledge & technology mapping services**	**N. firms to be offered knowledge-intensive services**	**Revenue from the sale of services**	
Band 1	> 160	50	160	40	500,000 €	800,000 €
Band 2	> 80	50	80	20	300,000 €	600,000 €
Band 3	> 40	50	40	10	150,000 €	400,000 €

Source: our elaborations using data provided by Tuscany's Regional government

In what follows we discuss these indicators in the light of their adequacy to promote the achievement of the policy's objectives, and we provide some evidence about the extent to which they induced behaviours that were misaligned with these objectives.

Our empirical analysis builds upon several data sources, listed in Table 4, which the authors assembled as part of a research team engaged in the analysis of the policy programme.

Table 4. Data sources

Type of data	Source
Data on poles' structure and activities	– Administrative data provided by Tuscany's regional government (poles' six-months activity reports and other administrative data) – Poles' websites (collected in September – January 2015) – 27 semi-structured interviews with staff from the organisations managing the innovation poles, some member firms and local business associations (carried out between March and May 2014), – Online survey of poles' managing organisations about the monitoring and evaluation activities they had to comply with (March-April 2015)[2] – Focus group with poles' managing organisations (May 2015)
Data on member firms	– Administrative data provided by Tuscany's regional government (data on the policy providing grants to buy knowledge-intensive services) – Interviews to poles' member firms, carried out between September and November 2015
Data on regional administration	– Administrative data provided by Tuscany's regional government (funding schemes for poles and member firms) – 4 interviews with policymakers (carried out between March and May 2014)
Data on 2000-2006 innovation policies	– Previous research projects of the authors

4. Limitations of the indicators used by the regional government

In order to identify any mismatches between the ultimate aim of the policy and the performance indicators that were established by the regional policymaker, we review the indicators in light of the objectives stated in the policy documents (Table 5). The key objectives of innovation poles were listed as follows (Regione Toscana, 2010):

1. To promote and meet the demand for innovation on the part of local firms, particularly SMEs and more fragile firms, which are not able to express such demand;
2. To expand the number of firms accessing high value-added knowledge-intensive services, in order to promote the diffusion of innovation across pole members and with external firms;
3. To help firms gain access to scientific and technological knowledge, and to networks and resources at national and international level;
4. To support the sharing of equipment and of research, development, testing

[2] The first email inviting the managing organisations to take part in the survey was sent on March 27th, 2015, followed by two recalls sent to non-respondents only. 14 (30%) out of the 46 managing organisations responded to the survey, 12 of these being the consortium leaders for the 12 poles. We focused our analysis on the 12 completed questionnaires received from the 12 consortium leaders.

and certification labs.

For some of these objectives, the policymaker clearly expresses the need to address specific system failures. For instance the first objective referred to awareness problems that could prevent SMEs from identifying their main needs and devising appropriate strategies to satisfy them. In other cases, the reference to specific types of system failures was more implicit, but it can nevertheless be deduced from reading the documents (Table 5, first column).

By establishing a logical link between the objectives of the policy, on the one hand, and the performance indicators designed by the regional policymaker, on the other hand, we can identify whether these indicators created behavioural incentives that were misaligned with the policy objectives (Table 5, third column).

The table shows that the policy objectives that the poles should have achieved (and the underlying types of system failures that the poles should have addressed), and the indicators used by the regional government to measure such achievement, were not clearly connected: instead, the indicators appeared only loosely tied to the policy objectives, and could easily incentivise the poles to adopt behaviours that were misaligned with the objectives of the policy.

The first policy objective (to promote and meet SMEs' demand for innovation) intended to address information and awareness failures: to remedy the SMEs' lack of information about technologies and innovation opportunities, and their lack of awareness of their own technological needs. The policymaker defined two indicators (minimum percentage increase in number of members and in the number of new member firms to be offered knowledge and technology mapping services) that measured the poles' engagement in recruiting members and marketing services to them. However, these indicators did not capture whether and to what extent the poles had been successful in solving the information and awareness failures that could affect local firms. These indicators may even have undermined the attainment of this objective since, in order to easily reach the target, poles could have chosen to approach firms that were easy to reach (e.g. firms that were already known to the poles' consortium members before the start of the poles' activities) rather than the most fragile firms, with greater awareness problems. The remaining two indicators (minimum number of firms to be offered knowledge-intensive services, and minimum revenue from the sale of services) may be related to the second policy objective, which was to address, and possibly

solve, managerial failures. However, also in this case the indicators were not directly measuring whether the poles had been successful in addressing managerial failures in regional firms, and, indeed, the indicators may have undermined the attainment of the second objective: in order to easily reach the targets, poles could have provided services to firms that were more willing to buy services (e.g., to firms that were already used to buy services or to more innovative firms) rather than to firms that had the greatest managerial problems.

Table 5. Policy objectives, performance indicators, and misaligned incentives

Policy objective ***(type of system failure addressed)***	**Performance indicators**	**Misalignment between poles' incentives and policy objectives**
Poles should promote and meet the demand for innovation, particularly in SMEs and more fragile firms who were unable to express such demand (*Information failures, awareness failures*)	% increase in number of members Minimum number of new member firms to be offered knowledge and technology mapping services	In order to easily reach the target, poles could have chosen firms that were easy to reach (e.g. firms that were known to the poles beforehand)
Poles should expand the number of firms accessing high value-added knowledge-intensive services (*Managerial failures*)	Minimum number of firms to be offered knowledge-intensive services Minimum revenue from the sale of services	In order to easily reach the target, poles could have provided services to firms that were more willing to buy services (e.g. to firms that were already used to buy services or to more innovative firms) and not to the other types of firms
Poles should help firms gain access to scientific and tech knowledge, and to networks and resources at national and international level Poles should support the sharing of equipment and certification labs *(Networking failures, cognitive failures)*	--	Poles could have chosen not to perform these activities (or put a very little effort in performing such activities) because they are not relevant to assess their performance

The policymaker also had two other objectives. However, no performance indicators were set that could be linked to those. This is an important mismatch between policy objectives and indicators, whose effect in creating misaligned incentives for the poles is easy to imagine. Poles could have chosen not to perform these activities (or to put a very little effort into them) because they were not relevant to their performance evaluation.

In what follows we focus on the empirical analysis of the potentially misaligned incentives created by performance indicators, while in section 6 we put

forward a reflection on what process and outcome indicators could be used to support intermediaries in addressing system failures.

5. Misalignment between poles' incentives and policy objectives

Table 6 summarizes the results achieved by each innovation pole in the period 2011-2014, ordered by band, and highlights those cases in which the targets had been reached in less than half the time allocated to these activities.

Table 6. Performance targets and their achievement

Innovation pole	**% increase in the number of member firms** (above the minimum initial threshold for each band)	**Firms with knowledge and technology mapping**	**Services provided**	**Revenue**
	%	*n.*	*n.*	€
Minimum target for Band 1	**50%**	**160**	**40**	**500,000**
Poles' final performance				
OTIR 2020	213%*	278*	93	1,592,970*
PENTA	120%*	236*	100	911,084*
POLIS	303%*	274*	88	1,022,348*
CENTO	101%*	190	115*	1,739,283*
POLO12	146%*	249*	267*	1,924,012*
POLITER	338%*	286*	191*	2,259,204*
Minimum target for Band 2	**50%**	**80**	**20**	**300,000**
Poles' final performance				
INNOPAPER	73%*	94	455*	711,608*
PIERRE	363%*	120	64*	1,082,638*
Minimum target for Band 3	**50%**	**40**	**10**	**150,000**
Poles' final performance				
OPTOSCANA	130%*	56	42*	312,210*
VITA	295%*	73*	31	249,893*
PIETRE	205%*	81	18	1,799,400*
NANOXM	222%*	44*	25	880,223*

Note to table: * Poles that achieved the target within the first three semesters of activity.

Source: our elaborations using data provided by the innovation poles to document their performance, reference period: 1st July 2011-30th June 2014

Even a quick glance at the poles' performance suggests that the targets were probably too low, given that most poles reached them very rapidly. All poles reached at least one of the performance targets within the first six months, and most of them had reached at least two targets within the first year. Moreover, all poles had reached all their performance target within two years. While the targets

could have been easy to reach in an absolute sense, this may also suggest the presence of incentives for the poles to act in ways that were misaligned with the policy's objectives: innovation poles may have strategically implemented actions aimed at achieving the targets, regardless of whether such actions were aligned with their ultimate objectives to address failures in the innovation system. To assess whether this might have been the case, we investigate several ways in which performance indicators might have affected the behaviour of the innovation poles.

In order to do so, we try to define some very simple indicators that can be used to identify the potential misalignment between the poles' incentives, on the one hand, and the policy objectives put forward in Table 5, on the other.

5.1. Misaligned incentives created by indicators related to the first objective.

Recruiting members among firms that were easy to reach and mapping their needs. To check whether poles recruited and provided mapping services to firms that were easy to reach, for example those they had already worked with prior to the policy programme, rather than focus on firms that were outside their established networks, we investigate how many of the member firms and of the mapped firms had been known to the poles' managing organisations before the start of the policy. We infer that firms and managing organisations knew each other if they had participated together in previous regional policy interventions. Based on information gathered from archives related to previous regional policies that supported R&D collaborations, we found that, on average, 20.3% of member firms had already cooperated with the poles' managing organisations. This percentage ranged from almost 50% for Optoscana, a pole managed by organisations that had been very active in the 2000-2006 policies, to 3.8% for Penta, whose leading organisation (Navigo) was not involved in the 2000-2006 policies. During their three years of activity, the poles' managing organisations continued to attract firms that had been their partners in previous policies, but at a decreasing rate. The share of mapped firms that had participated with the poles in the previous 2000-2006 policy programme climbed, over time, to about 50% on average.

Member recruitment without further activity. To check whether poles simply recruited members without intending to work closely with them, but just to

achieve their membership targets, we calculated how many of the member firms did not buy any services from the poles, and did not engage in any activity intermediated by the poles. On average, the poles involved only 2 member firms out 10 in some innovation-related activities during the three-year period. The remaining 8 firms interacted with the poles in order to gain membership, but were not subsequently involved in any other activity. In particular, out of the 3066 member firms, only 586 firms bought some innovation service offered directly by the poles of which they were members (19.1%). A further 75 firms bought services from other poles, without being members.

5.2. Misaligned incentives created by indicators related to the second objective: providing services to firms that were already accustomed to demanding them, or to firms that were already innovative.

If we consider only the 586 firms that bought services from the poles, 206 firms (35.2%), had already benefited from a public incentive to buy knowledge intensive services, before the poles were created, and 34 of these (5.8%) had already participated in the 2000-2006 regional innovation policy programmes.

Table 7 summarizes the extent to which poles offered services to member firms that had already requested services from the previous policy programme. The table shows that, on average, over a third (35.2%) of the member firms to which poles provided services had already been accustomed to requesting services beforehand. These firms accounted for 27.2% of the services provided and 42.7% of the value of these services. So, these firms on average demanded more expensive (which generally meant more complex and more knowledge-intensive) services. It is also interesting to observe that, of the 206 firms that had already requested services from the previous policy programmes, almost half (92, that is 15.7% of the set of firms that bought services from the poles) went on to demand the same type of services from the poles. For these firms, the poles appear to have simply crowded out other service providers.

In addition, we found that 60% of the firms that demanded services from the poles were innovative firms, i.e. before the start of the policy they had carried out either internal R&D activities or external R&D in collaboration with other organisations, while this percentage drops to 10% in the group of member firms that did not buy any services.

Table 7. Service provision to member firms that were already accustomed to demand services

Pole	Member firms that had already requested services from the previous policy programme before requesting them from the poles:		
	Number of firms, as a share of member firms	Number of services provided, as a share of services provided to member firms	Value of services provided, as a share of the value of services provided to member firms
OPTOSCANA	22.2%	20.6%	1.3%
INNOPAPER	25.7%	8.3%	28.9%
OTIR 2020	43.8%	47.1%	79.4%
VITA	12.5%	8.8%	17.9%
PIETRE	-	-	-
PENTA	27.3%	34.5%	47.3%
POLIS	45.8%	48.6%	57.1%
NANOXM	36.4%	40.0%	33.8%
CENTO	36.2%	43.7%	58.4%
PIERRE	28.6%	25.4%	28.1%
POLO12	28.4%	24.9%	42.6%
POLITER	45.5%	45.5%	53.6%
average	35.2%	27.2%	42.7%

5.3. Misaligned incentives created by indicators related to the third objective: avoiding activities whose performance was not measured by indicators.

Our survey of the poles' managing organisations suggests that 11 poles out of 12 carried out activities in order to support member firms' access to scientific and technological knowledge, and to networks and resources at national and international level. However, about 40% of the member firms that we interviewed claimed to have been contacted by the poles only once, with the objective to recruit them as members.

Based on this information, poles seem to have put very little effort in performing these activities, even if they were required to achieve some policy objectives. Therefore, also in this case the indicators (or lack thereof) seem to have produced misaligned incentives.

Summarizing, through our empirical analysis we found some evidence that the poles adopted behaviours that were misaligned with the policy's objectives. Poles built their network of members by extensively relying on their network of pre-existing connections, and engaged with their members to a limited extent: 8 member firms out of 10 did not demand any knowledge intensive services, and

40% did not have any contact with the poles after they had gained membership. Many of the services were provided to firms that did not need the poles' intermediation. We found that 35.2% of the firms that demanded services from the poles would have been able to buy them even without the intermediation of the poles; for half of these firms, the poles simply crowded out other services providers instead of providing different services. Activities for which performance targets had not been set, were carried out only to a limited extent.

6. Towards a better approach to evaluating the performance of innovation intermediaries

The performance indicators used by the regional government had several limitations. First, they were incomplete because they only focused on some of the poles' activities. Second, they were not explicitly designed to support the achievement of policy objectives. Much of the recent debate on the evaluation of intermediaries' performance focuses on the need to introduce outcome indicators that capture significant changes in the behaviours of beneficiary firms and significant social and economic effects at various levels of analysis. However, while the use of outcome indicators is crucial in order to understand the overall effects of the policy programme, it might not in itself correct the misalignment between the incentives created by the indicators and the policy's objectives, if the indicators are not aligned with the latter. Instead, we argue that the key problem when defining performance targets and performance indicators (especially, but not only, when they are used to allocate public funding) is to closely align such indicators with the policy's objectives.

Building on the conceptualisation of the policy's objectives in terms of system failures as outlined in Table 1, we can identify a number of indicators that could have been used for performance evaluation. These indicators could have measured the outputs of the poles' activities, both direct ones (activities performed by the poles) and indirect ones (follow up activities that resulted from the former). It would have been important to also include (if the policy's time

scale allowed it) the outcomes achieved by the beneficiary firms thanks to the poles' activities.[3] Outcome indicators could have measured whether the economic actors had changed their behaviours (for example, greater networking activity, changes in the types of partners they interact with, changes in the type of innovation processes they perform) and possibly in performance (more innovation, greater profitability and so on), as a consequence of having acquired resources (information, services, contacts) and engaged in learning processes that had allowed them to improve their capabilities to engage in innovation (for example, through better communication and negotiation skills, greater awareness of their own abilities and of their limitations, greater understanding of the process of collaboration, greater trust and openness toward external collaborations), thanks to the poles' activities.

Table 8 summarizes the possible measures for the evaluation of the poles' performance, which result from an integration of our proposed conceptual framework with our empirical findings. The proposed measures are classified by policy objective, and corresponding system failures, and by their type (direct output, indirect output, or outcome indicators).

The indicators proposed here refer to the case of innovation poles, but they can be easily adapted to many types of intermediaries.

[3] In order to capture the actual contribution of the innovation poles to the changes in the behaviours of the beneficiary firms, outcomes can be evaluated not just descriptively but also causally, through the counterfactual tools of the so-called econometrics of program evaluation (Imbens and Rubin, 2015). However, the application of these tools to the field of system failures is still in its infancy.

Table 8. Policy objectives, expected outcomes and proposed indicators

Types of system failures addressed	Proposed indicators
Information failures, awareness failures	*Direct output:* Number of new (not previously known) firms recruited
	Direct output: Number of new (not previously known) firms mapped
	Indirect output: Number and value of follow-up activities carried out with the firms recruited
	Indirect output: Number of new firms that were offered mapping services, that engaged in follow-up activities
	Outcome: Changes in firms' internal innovation behaviour: nature and types of investments in innovation; nature and value of the research project proposals submitted and funded; types of innovation strategies
Managerial failures	*Direct output:* Number and value of services provided or intermediated by the innovation intermediary to firms that had not demanded that kind of services before, or that had never demanded services
	Direct output: number of firms receiving services directly provided or mediated by the innovation intermediary that had not demanded that kind of services before, or that had never demanded services
	Indirect output: Number and value of subsequent services provided to these firms
	Indirect output: Number of firms receiving services that requested further services
	Outcome: Changes in firms' demand for knowledge-intensive services: number of firms demanding services, number of services demanded
Networking failures, cognitive failures	*Direct output:* Number of events held (by type of event)
	Direct output: Number of firms participating in events
	Indirect output: Number and value of follow-up activities carried out with these firms
	Indirect output: Number of firms involved in events, that engaged in follow-up activities
	Outcome: Changes in firms' networking behaviour: size and composition of networks of relationships; number and types of collaborative projects

7. Conclusions

In recent years, policymakers have relied on intermediaries to stimulate the innovative capacity of firms (especially those that are not able to express their demand for innovation), to find new partners to work with, new knowledge and new technologies. In addition, intermediaries can play an important role in strengthening the connections between actors within an innovation system. However, if the intermediaries' incentives are not aligned to the pursuit of these objectives, there are few reasons to believe that these objectives will be achieved.

While evaluation exercises often analyse whether the intermediaries' behaviour was in line with the stated aims of the policy, very rarely they seek to understand the extent to which this behaviour was affected by the policy design. Our study attempts to bring to light the possible misaligned incentives created by linking the allocation of funding to performance indicators that are not fully in line with the policy's objectives.

The evidence suggests that the policy had incentivised the poles to focus on some activities and not on others, and to provide support to firms that did not necessarily need it. Two further issues have been implicitly raised by our analysis. First, while the chosen performance indicators seem to have generated some misaligned incentives, this does not mean that the policy as a whole was ineffective. Establishing this would have required an appropriate ex post evaluation, possibly including a counterfactual analysis. Second, establishing performance-based indicators is very important, although not always easy. Indeed, this activity is constrained by the presence of a trade-off. By setting indicators that are simple to compute and not too demanding in terms of data requirements, the intermediaries only need to invest a limited amount of resources in the evaluation process, and can engage in more productive activities instead. But indicators are often too loosely related to the policy's ultimate objectives to address failures both at firm level and at system level. To achieve a balance it is necessary, first of all, to single out, for each of the policy objectives, what are the short and medium term expected outcomes of the policy. Then, output measures for intermediaries' performance – aligned with those outcomes – may include a wide range of indicators, such as, for example, those that we defined in Table 8, which are strongly connected with the policy objectives, and may directly incentivise intermediaries to become more effective.

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